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EP 0653701 A1 US 5220639 A

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(71) Applicant(s)
Mitel Corporation
(Incorporated in Canada - Ontario)
PO Box 13089, 350 Legget Drive, Kanata,
Ontario K2K 1X3, Canada

(72) Inventor(s)
Dave Jarvis
Gordon Freedman

(74) Agent and/or Address for Service
Reddie & Grose
16 Theobalds Road, LONDON, WC1X 8PL,
United Kingdom

(54) Abstract Title
Voice activated control system and method

(57) A voice activated control system 10 includes a microphone 12 into which a voice command is inputted. A speech recognition unit 14 coupled to the microphone recognizes the input voice command when it corresponds with a voice command stored therein. A voice command attribute detector 16 is also coupled to the microphone and detects the value of a parameter of at least one attribute of the input voice command, for example its volume or the pitch. A controller 20 is responsive to the speech recognition unit 14 and voice command attribute detector 16 when the input voice command is recognized, and executes an operation associated with the recognised input voice command. The controller varies the execution of the operation in accordance with the value of the detected parameter of the at least one attribute. The system can be used to control a drawing package on a PC, or in appliances such as stereos, light dimmers etc.

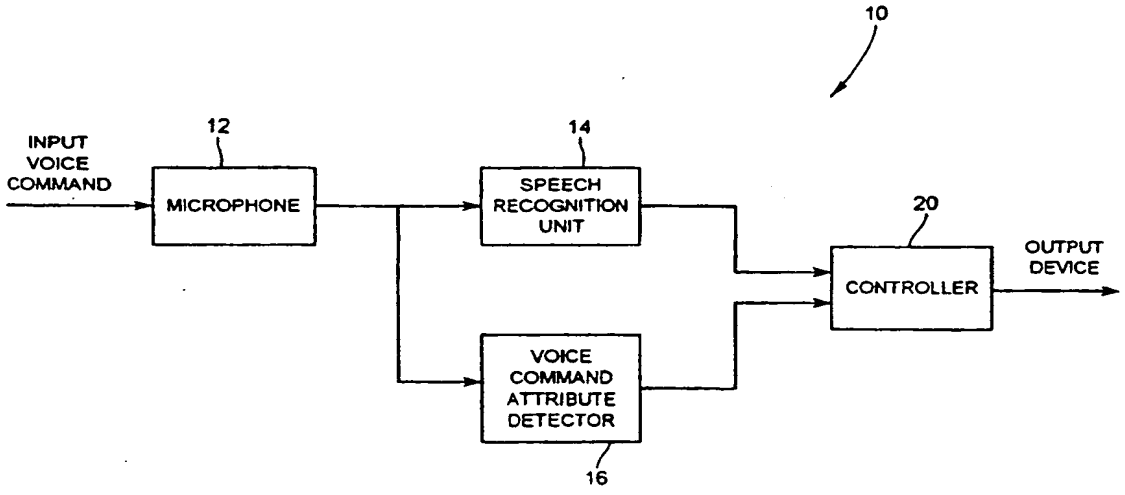

FIG. 1

GB 2 326 490 A

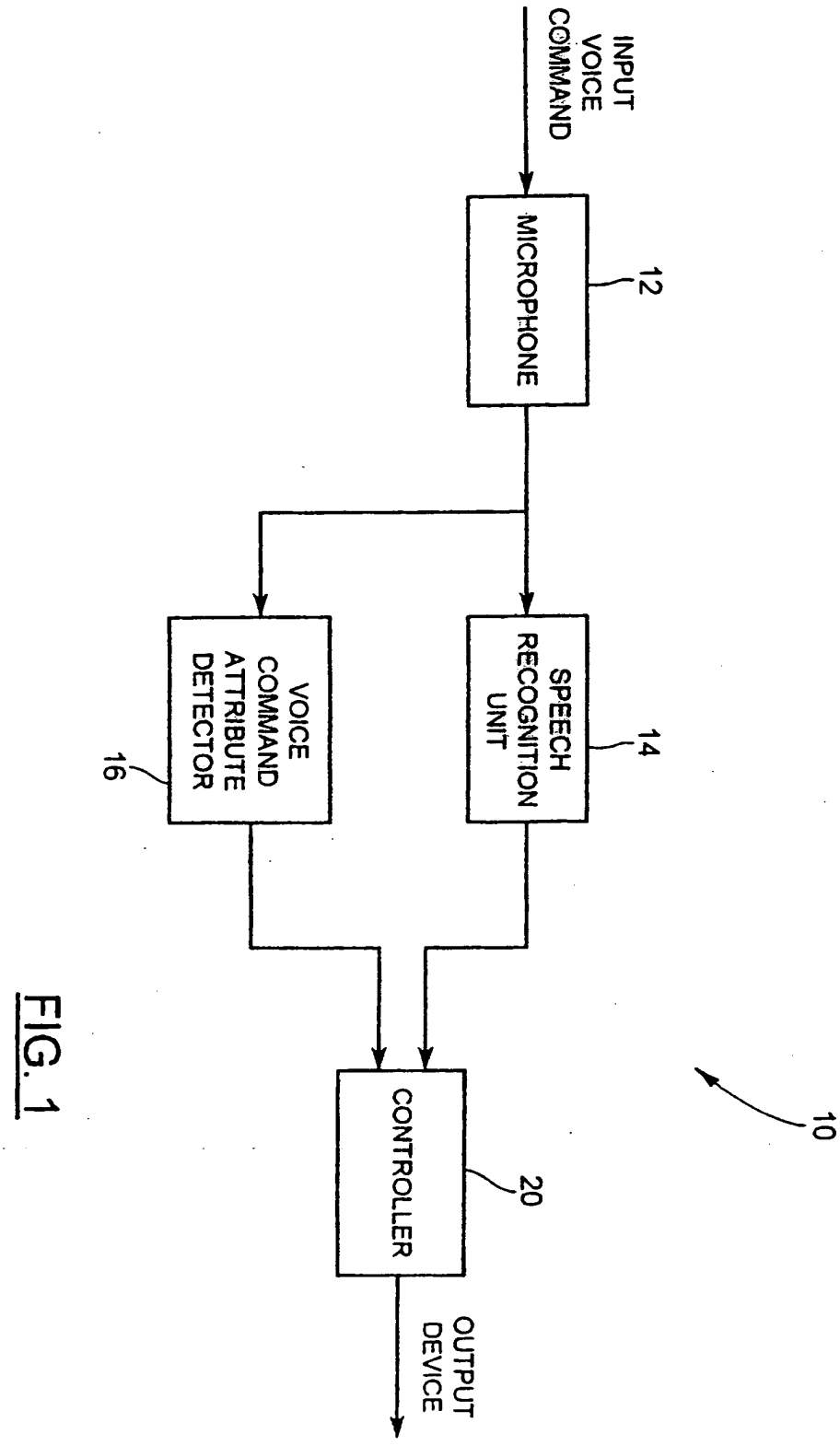
INPUT VOICE COMMAND
MICROPHONE
12
SPEECH RECOGNITION UNIT
14
VOICE COMMAND ATTRIBUTE DETECTOR
16
CONTROLLER
20
OUTPUT DEVICE
10

FIG. 1

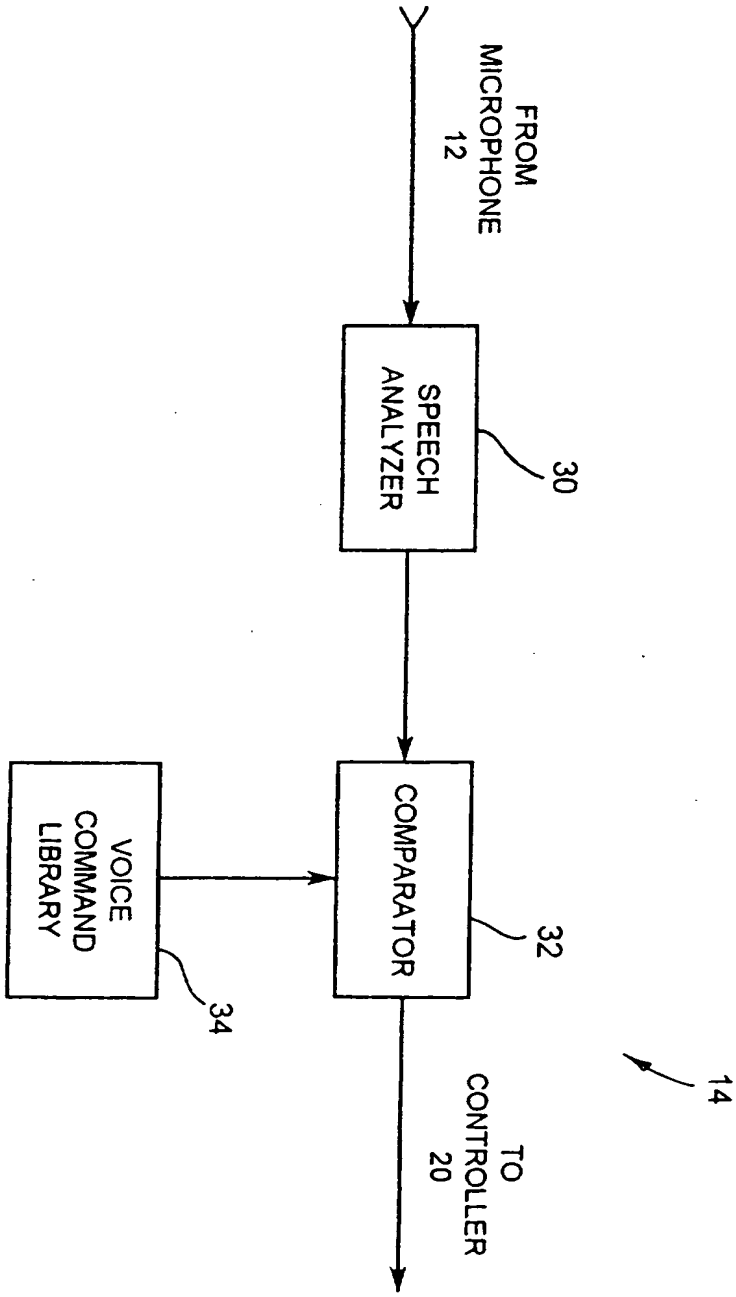
FROM MICROPHONE 12
SPEECH ANALYZER
30
COMPARATOR
32
VOICE COMMAND LIBRARY
34
TO CONTROLLER 20
14

FIG. 2

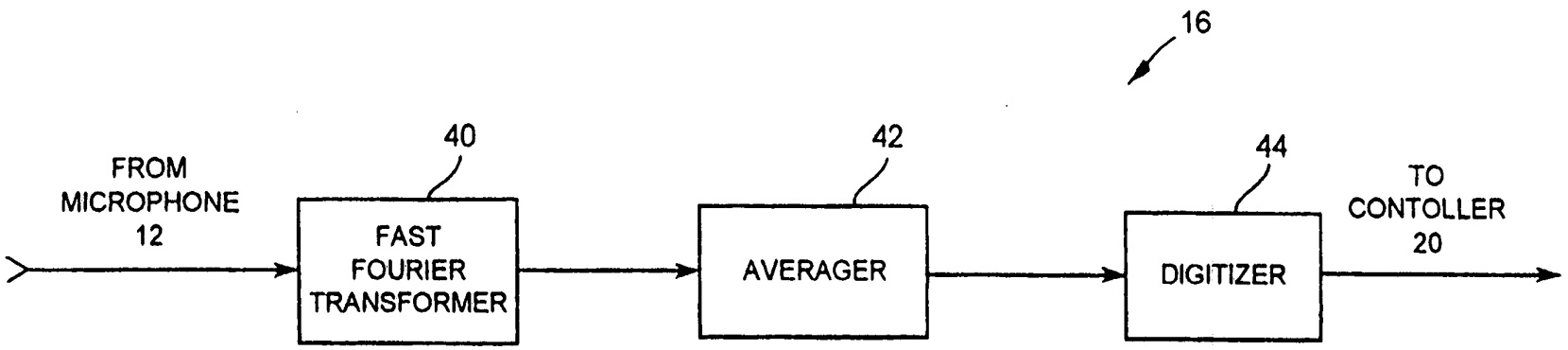
16
40
42
44
FROM
MICROPHONE
12
FAST
FOURIER
TRANSFORMER
AVERAGER
DIGITIZER
TO
CONTOLLER
20

FIG. 3

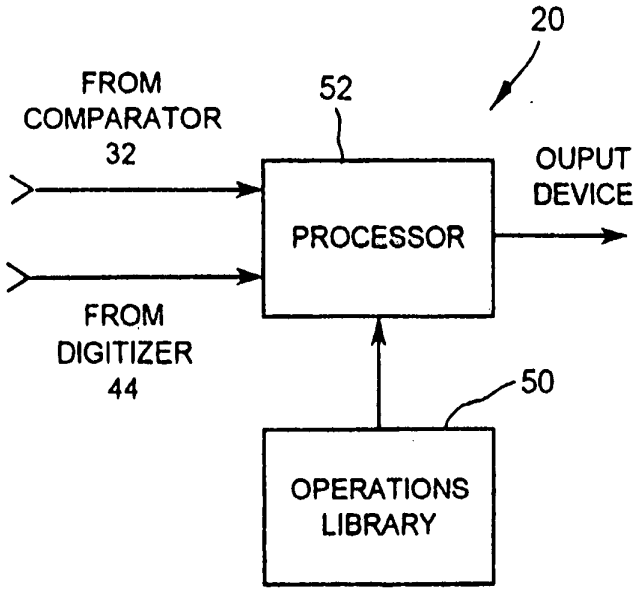
20
52
FROM
COMPARATOR
32
PROCESSOR
OUPUT
DEVICE
FROM
DIGITIZER
44
50
OPERATIONS
LIBRARY

FIG. 4

VOICE ACTIVATED CONTROL SYSTEM AND METHOD

Field Of The Invention

The present invention relates to control systems and in particular to a voice activated control system and method to allow input voice commands to be used to initiate execution of an operation and to vary the execution of the operation.

Background Of The Invention

Voice activated control systems to allow input voice commands to be used to initiate execution of an operation are known in the art. For example, U.S. Patent No. 4,704,696 to Reimer et al discloses a video game responsive to voice commands to obviate the need for a joystick. The video game partitions input voice commands and determines the frequency content of the input voice command in the various partitions. The determined frequencies in the various partitions are compared with stored data in the video game to determine if the input voice command corresponds with a voice command stored in memory within the video game. If a correlation occurs, the video game executes an operation corresponding to the input voice command to alter game play.

U.S. Patent No. 5,220,639 to Lee discloses a Mandarin speech recognition machine which can be trained to recognize different tones of syllable utterances to facilitate correlation of an uttered tone with corresponding tones stored in memory within the speech recognition machine. This allows spoken syllables and tones to be recognized in order to distinguish Mandarin speech. Recognized sentences are converted into Chinese characters and displayed on a computer screen.

U.S. Patent No. 5,345,538 to Narayannan et al discloses a speech recognition system for controlling movement of a microscope in response to detected input voice commands. Different input voice commands cause similar movements of the microscope at different rates. Input voice commands exceeding a threshold level cause the system to stop movement of the microscope regardless of whether the input voice command is recognized.

Although the above-described references disclose voice command recognition systems for detecting and recognizing input voice commands and executing operations in response to the recognized voice commands, these prior art systems are limited in that the executed operations are preset and are based solely on the recognized voice commands themselves regardless of variations in the manner in which the voice commands are spoken. As such, quantitative variances in the executed operations are not possible.

It is therefore an object of the present invention to provide a novel voice activated control system and method which obviate or mitigate at least one of the disadvantages associated with the prior art.

Summary Of The Invention

According to one aspect of the present invention there is provided a voice activated control system comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone and recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a voice command attribute detector detecting the value of a parameter of at least one attribute of said input voice command; and

a controller responsive to said speech recognition unit and said voice command attribute detector when said input voice command is recognized and executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

In one embodiment, the voice command attribute detector detects the volume level of the input voice command. In another embodiment, the voice command attribute detector detects the tone of the input voice command. The voice activated control system can be used to control an appliance or alternatively to modify the execution of software.

According to another aspect of the present invention there is provided a voice activated control system comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone for recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a volume and/or tone detector for detecting the volume level and/or tone of said input voice command; and

a controller responsive to said speech recognition unit and said volume and/or tone detector when said input voice command is recognized and executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the detected volume level and/or tone of said input voice command.

According to still yet another aspect of the present invention there is provided a method of controlling the execution of an operation associated with an input voice command, said method comprising the steps of:

comparing an input voice command with stored voice commands and recognizing said input voice command when a match occurs;

detecting the value of a parameter of at least one attribute of said recognized input voice command; and

executing an operation associated with said recognized input voice command when a match occurs, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

According to still yet another aspect of the present invention there is provided a control system for an appliance comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone for recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a voice command attribute detector for detecting the value of a parameter of at least one attribute of said input voice command; and

a controller responsive to said speech recognition unit and said voice command attribute detector when said input voice command is recognized and executing an operation associated with said recognized input voice command to control said appliance, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

According to still yet another aspect of the present invention there is provided a computer readable media encoded with a computer program for controlling the execution of an operation comprising:

means for recognizing an input voice command when said input voice command corresponds to a stored voice command;

means for detecting the value of a parameter of at least one attribute of said input voice command; and

means for executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

The present invention provides advantages in that input voice commands and attributes of the input voice commands such as for example volumes and/or tones can be used to control the operation of an output device. This allows quantitative variances in the execution of operations associated with the input voice commands to be achieved by changing the volume and/or tone of input voice commands.

Brief Description Of The Drawings

Embodiments of the present invention will now be described more fully with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a voice activated control system in accordance with the present invention;

Figure 2 is a block diagram of a speech recognition unit forming part of the voice activated control system of Figure 1;

Figure 3 is a block diagram of a voice command attribute detector forming part of the voice activated control system of Figure 1; and

Figure 4 is a block diagram of a controller forming part of the voice activated control system of Figure 1.

Detailed Description Of The Preferred Embodiments

Referring now to Figure 1, a voice activated control system (VACS) to allow input voice commands to be detected and used to control the operation of an output device is shown and is generally indicated to by reference numeral 10. As can be seen, the VACS 10 includes a microphone 12 into which voice commands are input. Coupled to the microphone 12 is a speech recognition unit 14 and a voice command attribute detector 16. Speech recognition unit 14 analyses voice commands input into the microphone 12 to determine if entered voice commands correspond to voice commands stored in memory therein. The voice command attribute detector 16 analyses input voice commands to determine the value of a parameter of at least one attribute of the input voice command such as for example, the volume level or tone of the input voice command. In this particular embodiment, the voice command attribute detector 16 detects the volume level of the input voice command. A controller 20 is responsive to the speech recognition unit 14 and to the voice command attribute detector 16 when an input voice command is recognized and executes an operation to control the output device in accordance with the detected input voice command and the detected volume level of the input voice command.

Referring now to Figure 2, the speech recognition unit 14 is better illustrated. The speech recognition unit may be of any conventional type which can be trained to recognize selected input voice commands such as that sold by Lyrix or alternatively can be built using a tool kit of subroutines such as Apple® Computer's Speech Recognition Manager. In this embodiment, the speech recognition unit 14 includes a speech analyzer 30 for detecting syllables and extracting features of an

input voice command and for generating a digital signature representing the input voice command. A comparator 32 is coupled to the speech analyzer 30 and to memory in which a voice command library 34 is stored. The comparator 34 compares the generated digital signature with digital signatures stored in the voice command library 34 which represent valid voice commands recognizable by the speech recognition unit 14. If a match is detected, the comparator 34 conveys the digital signature to the controller 20.

Figure 3 better illustrates the voice command attribute detector 16. As can be seen, the voice command attribute detector includes a fast fourier transformer 40 to perform a fast fourier transform on the input voice command and thereby separate the input voice command into its frequency components. An averager 42 is in communication with the fast fourier transformer 40 and determines the mean amplitude of the frequency components to generate an "average" volume level of the input voice command. A digitizer 44 is connected to the averager 42 to convert the average volume level into a digital value.

The controller 20 is best illustrated in Figure 4 and includes memory storing an operations library 50 as well as a processor 52 for selecting and executing operations from the operations library 50. Specifically, the processor 52 selects operations from the operating library 50 which are associated with the digital signatures received from the speech recognition unit 14. The digital values received from the voice command attribute detector 16 are used by the processor 52 during execution of the selected operations, to determine the extent of the executed operations.

Preferably, the speech recognition unit 14, the voice command attribute detector 16 and the controller 20 are implemented in software executed by a personal computer or the like. It should however, be appreciated by those of skill in the art that if desired, the speech recognition unit, the voice command attribute detector and the controller can be constituted by discrete components.

The general operation of the VACS 10 will now be described. When a voice command is input into the microphone 12, the speech recognition unit 14

analyses the input voice command to determine if the input voice command corresponds to a voice command stored in the voice command library 34. At the same time, the voice command attribute detector 16 analyses the input voice command to determine the average volume level of the input voice command. If the input voice command does not correspond with a voice command stored in the voice command library, the input voice command is ignored.

If the input voice command corresponds with a voice command stored in the voice command library 34, the controller 20 receives the digital signature from the speech recognition unit 14 and selects the operation in the operations library 50 corresponding to received digital signature. The controller 20 also receives the digital volume level from the command attribute detector 16 and uses the digital value to establish the value of a parameter of the selected operation. Once the value of the parameter has been determined, the processor 52 executes the selected operation to control the output device. Thus, when an input voice command is input into the microphone 12, two variables, namely the input voice command itself and the value of the average volume level of the input voice command, are used during execution of an operation. In many environments, this allows two actions to be performed simultaneously which otherwise would be required to be performed individually.

The VACS 10 is useful in many environments such as in computer systems where the execution of commands can be controlled by input voice commands. For example, the VACS 10 can be incorporated into or used in conjunction with a drawing software program such as for example Corel Draw®. As is well known to those of skill in the art, drawing software programs of this nature include selectable icons representing geometrical shapes which can be drawn on a palette. When one of these icons is selected, the geometrical shape is drawn on the pallet when the cursor is dragged across the palette. The extent to which the cursor is dragged determines the size of the drawn geometrical shape. As will be appreciated, the drawing of the geometrical shape on the palette requires two distinct and separate operations to be performed, namely selection of the icon and then dragging of the cursor across the palette to size the geometrical shape being drawn.

When the VACS 10 is incorporated into such a drawing software program, an input voice command is used to select and draw the desired geometrical shape. The volume level of the input voice command is used to determine the size of the drawn geometrical shape.

In this embodiment, the speech recognition unit 14 is trained to recognize input voice commands corresponding to geometrical shapes and lines as well as actions associated with moving drawn shapes and/or lines. The voice command library 34 includes a command vocabulary comprising of the voice commands "circle", "square", "ellipse", "rectangle", "spiral", "line", "up", "down", "left", "right", "rotate" etc. This list of voice commands in the voice command library 34 is presented for illustrative purposes only. It should be apparent to one of skill in the art, that more or fewer voice commands can be included in the voice command library.

During execution of the VACS 10 in conjunction with the drawing software program, when a user inputs a voice command such as for example "circle" into the microphone 12, and the voice command is recognized by the speech recognition unit 14, the controller 20 executes an operation resulting in a circle being drawn on the palette. However before doing so, the controller 20 uses the detected volume level of the input voice command to establish the diameter of the drawn circle. Thus, a softly spoken "circle" input voice command will result in a small circle being drawn, while a loudly spoken "circle" input voice command will result in a large circle being drawn. A similar process is performed when other voice commands representing geometrical shapes and lines are input into the microphone 12.

With respect to voice commands representing actions, the detected volume level determines the extent of the action performed. For example, a softly spoken "rotate" input voice command will result in a selected drawn object being rotated about a selected axis by a small amount while a loudly spoken "rotate" input voice command will result in the selected object being rotated by a larger amount.

As one will appreciate, the VACS 10 can also be used in a Windows® environment to allow input voice commands to be used to open, size and move windows.

The VACS 10 is also useful in appliances and other consumer products such as for example in stereos, light dimmers, power window controllers etc. In the case of stereos, the VACS 10 can be used to turn a stereo on and/or change the volume of the stereo. In the case of light dimmers and power window controllers, the VACS 10 can be used to change the illuminance of the light or position of the windows.

Although the VACS 10 has been described as detecting the volume level of the input voice command to vary the execution of the operation, other attributes of the input voice command such as for example tone may be used to vary the execution of the operation. Also, if desired the VACS 10 may include both volume level and pitch detectors. Those of skill in the art will appreciate that the present invention can be used in many applications and although particular embodiments have been described, it should be realized that variations and modifications may be made to the present invention without departing from the spirit and scope thereof as defined by the appended claims.

We Claim:

1. A voice activated control system comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone and recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a voice command attribute detector detecting the value of a parameter of at least one attribute of said input voice command; and

a controller responsive to said speech recognition unit and said voice command attribute detector when said input voice command is recognized and executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

2. A voice activated control system as defined in claim 1 wherein said voice command attribute detector includes a volume detector for detecting the volume level of said input voice command.

3. A voice activated control system as defined in claim 1 wherein said voice command attribute detector includes a pitch detector for detecting the tone of said input voice command.

4. A voice activated control system as defined in claim 1 wherein said voice command attribute detector includes a volume detector and a pitch detector.

5. A voice activated control system as defined in claim 1 wherein said controller controls the operation of an appliance during execution of said operation.

6. A voice activated control system as defined in claim 1 wherein said controller modifies the execution of software during execution of said operation.

7. A voice activated control system comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone for recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a volume and/or pitch detector for detecting the volume level and/or tone of said input voice command; and

a controller responsive to said speech recognition unit and said volume and/or pitch detector when said input voice command is recognized and executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the detected volume level and/or tone of said input voice command.

8. A voice activated control system as defined in claim 7 wherein said controller controls the operation of an appliance during execution of said operation.

9. A voice activated control system as defined in claim 7 wherein said controller modifies the execution of software during execution of said operation.

10. A method of controlling the execution of an operation associated with an input voice command, said method comprising the steps of:

comparing an input voice command with stored voice commands and recognizing said input voice command when a match occurs;

detecting the value a parameter of at least one attribute of said recognized input voice command; and

executing an operation associated with said recognized input voice command when a match occurs, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

11. The method of claim 10 wherein at said detecting step, the volume level of said input voice command is detected.

12. The method of claim 10 wherein at said detecting step, the tone of said input voice command is detected.

13. The method of claim 10 wherein at said detecting step, the volume level and tone of said input voice command are detected.

14. A control system for an appliance comprising:

a microphone into which a voice command is input;

a speech recognition unit coupled to said microphone for recognizing an input voice command when said input voice command corresponds to a voice command stored therein;

a voice command attribute detector for detecting the value of a parameter of at least one attribute of said input voice command; and

a controller responsive to said speech recognition unit and said voice command attribute detector when said input voice command is recognized and executing an operation associated with said recognized input voice command to control said appliance, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

15. A control system as defined in claim 14 wherein said voice command attribute detector includes a volume detector for detecting the volume level of said input voice command.

16. A control system as defined in claim 14 wherein said voice command attribute detector includes a pitch detector for detecting the tone of said input voice command.

17. A control system as defined in claim 14 wherein said voice command attribute detector includes a volume detector and a pitch detector.

18. A computer readable media encoded with a computer program for controlling the execution of an operation comprising:

means for recognizing an input voice command when said input voice command corresponds to a stored voice command;

means for detecting the value of a parameter of at least one attribute of said input voice command; and

means for executing an operation associated with said recognized input voice command, variances in the execution of said operation being determined by the value of the detected parameter of said at least one attribute.

19. A computer readable media as defined in claim 18 wherein said detecting means detects the volume level of said input voice command.

20. A computer readable media as defined in claim 18 wherein said detecting means detects the tone of said input voice command.

The Patent Office

14

Application No: GB 9712962.1 **Examiner:** James Porter
Claims searched: 1-17 **Date of search:** 5 September 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G3N (NG1A2); H4K (KBNJ)

Int Cl (Ed.6): G06F 3/16; G10L 5/06, 7/08, 9/06, 9/08, 9/10, 9/12, 9/14
H04M 1/27; H05B 6/68, 37/02, 39/04

Other: Online database: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP0653701 A1	(IBM) See whole document	1, 2, 5, 7, 8, 10, 11, 14, 15
X	US5220639 A	(NATIONAL SCIENCE COUNCIL) See whole document	1, 3, 6, 7, 9, 10, 12, 14, 16

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.